Australian National Botanic Gardens

Growing Native Plants

No.9

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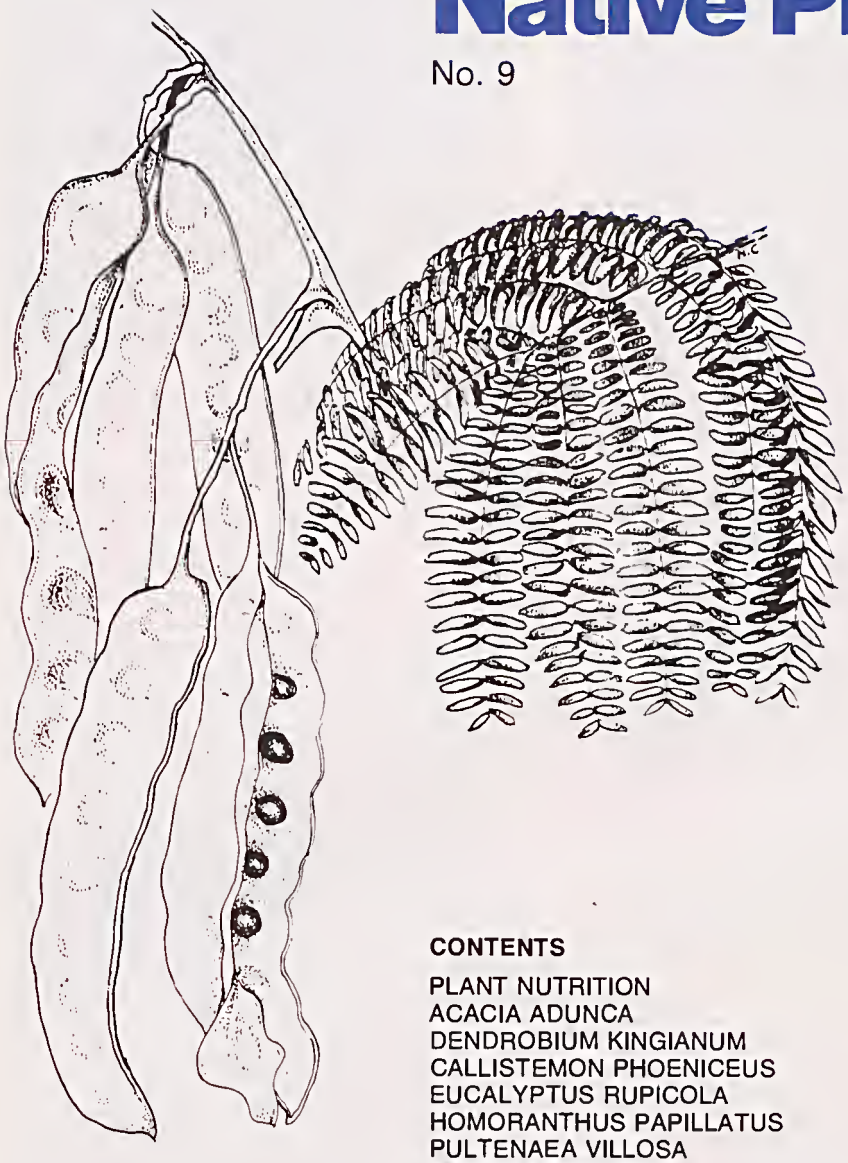

Albizia lophantha

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PLANT NUTRITION

The plant's needs

Plants, like all organisms, are built of carbohydrates, proteins, fats and nucleoproteins and need for their functioning other complex proteins called enzymes. In turn, to build these complex organic compounds the plant requires large quantities of carbon, oxygen, hydrogen, phosphorus, potassium, calcium, magnesium and sulphur. These are the major nutrients. Small quantities of the minerals iron, manganese, zinc, copper, boron, molybdenum and cobalt—the minor nutrients—are required for the function of enzymes. Rapid growth can only occur when there is an adequate quantity of enzymes present and hence only after the plant has absorbed adequate quantities of the minor nutrients for their functioning. The maximum demand occurs when the plant is young. As the plant matures many of the minor nutrients are recycled within the plant, which transfers them from old cells to the new growing points to build new enzymes there. The major nutrients—nitrogen, phosphorus, sulphur, potassium and magnesium—can also be recycled within the plant but a continuous uptake by the plant must occur if continuous growth is to be achieved.

Source of nutrient elements

From where do plants get these elements? Carbon dioxide and water are probably the sole sources of carbon and hydrogen for most plants, while adequate nitrogen is usually provided by ammonium and nitrate ions in the soil. Some leguminous and other plants, however, can supplement this with nitrogen from the air while insectivorous plants derive nitrogen from the digestion of animal matter. The other elements are usually taken up by the plants from the soil as simple inorganic ions.

How nutrients occur in soil

Nutrients occur in soils in several forms. The nutrients most readily available to the plant are those dissolved in the soil water. Nutrient elements may also be found attached to the surface of soil particles as charged ions. A further source is complex organic molecules in humus which are continually broken down by micro-organisms to release nutrient elements. The rate of this breakdown is influenced by the type of micro-organisms, temperature and pH. Nutrient elements are also combined with other elements in soil structure. But in this case are both released and made available to plants very slowly.

Soil pH and nutrient availability

The pH of the soil can influence the availability of nutrient elements to plants. Generally elements are most available at a soil pH of 6.5 and therefore a pH range of 6.0-7.0 is considered the most desirable for plant growth. At pH values above and below this nutrient availability may be severely limited. At higher pH values (more alkaline) deficiencies in iron, manganese and boron may appear. At lower pH values (more acid) the availability of molybdenum, calcium and phosphorus may be limited.

Major nutrient elements

Nitrogen is essential for plant growth as it is a key element in proteins and nucleic acids. It is taken up by the plant as either the nitrate or ammonium ion and while sufficient quantities are present in the soil, continued plant growth can occur. In nature the soil ammonium and nitrate ions are derived from several sources: the breakdown of organic matter, oxides of nitrogen dissolved in rain water and the fixation of atmospheric nitrogen by soil micro-organisms.

As the amount of nitrogen available to the plant increases the extra protein synthesis which occurs leads to an increase in the size of the leaves. Coupled with this increase in leaf area there is usually a decrease in the thickness of cell walls. The soft plant tissue formed at high nitrogen levels is readily attacked by insects and fungi and harmed by adverse weather such as drought and frosts. A low nitrogen supply, on the other hand, results in small leaves with small, thick-walled cells. The leaves are therefore harsh and fibrous. Where there is a severe nitrogen deficiency no chlorophyll is produced and the leaves turn a pale yellow. The older leaves are usually affected first.

Deficiencies in nitrogen can be overcome by the application of nitrogen fertilisers, divided into quick release and slow release forms. Examples of the former are ammonium sulphate, ammonium nitrate and urea, and of the latter, blood and bone, compost, ureaformaldehyde, sulphur-coated urea and resin-coated fertilisers (for example, Osmocote®,

A nitrogen deficient (right) and control plant of *Helichrysum bracteatum*. In the deficient plant nitrogen has been translocated from the lower leaves to the new growth.

A phosphorus deficient (right) and control plant of *Helichrysum bracteatum*. In the deficient plant phosphorus has been translocated from the older leaves and the newer leaves are darker green and set at a more acute angle to the stem.

Nutricote®). For good plant growth a compromise between the two growth extremes mentioned above must be established. High levels of nitrogen, therefore, should not be applied in late autumn or in winter.

Phosphorus plays a fundamental role in a very large number of enzymic reactions, including those associated with photosynthesis and the cell nucleus. It is essential for cell division and the development of meristematic tissue. In actively growing leaf and root tissue its concentration is 100 to 1000 times that found in cells which have ceased to divide. The total quantities within a plant are considerably smaller than those of nitrogen or potassium.

The Australian flora has generally evolved in soils naturally very low in phosphorus and many genera, notably in the family Proteaceae, have evolved very efficient systems for taking up and storing phosphorus released by the breakdown of leaf litter. Considerable evidence has been collected indicating phosphorus toxicity in Australian plants when phosphate fertilisers are added at levels required by exotic species. Superphosphate, in particular, should be avoided with native species. The symptoms of phosphorus toxicity vary with the species but always involve necrosis and abscission of mature leaves. The plants become sparse because of defoliation and, in severe cases die.

It is generally considered that plants absorb most of their phosphorus as the dihydrogenphosphate ion (H_2PO_4-). Phosphorus can be translocated within a plant and when there is a deficiency in the soil the plant is able to withdraw some of the phosphorus from the lower leaves and transfer it to the young actively growing tissue. In severe deficiency the leaves often become purplish in colour and the new leaves are smaller. It must be remembered, however, that the purplish colour can also occur as a result of low temperatures and sometimes in nitrogen deficiency.

Potassium is important in the synthesis of amino acids and proteins and in carbohydrate metabolism. A deficiency results in a decrease in photosynthesis. Potassium is also involved in the activation of various enzymes and the growth of meristematic tissue. There is an important relationship between the availability of potassium and the resistance of plants to fungal disease. Potassium is translocated to the younger meristematic tissue if a shortage occurs. As a result the deficiency symptoms usually appear first on the lower leaves. Plants which are deficient usually develop chlorotic symptoms and sometimes slow scorching of the leaf edges. The balance between nitrogen and potassium is important in

the hardening of plants before the onset of winter. A deficiency in potassium may be corrected by the use of potassium sulphate or combined nitrogen-phosphorus-potassium (NPK) fertiliser.

Calcium appears to be essential for the growth of meristems and particularly for the proper growth and functioning of root tips. A deficiency produces stunting of the root system and prevents the development of the buds of the plant. Many soils are low in calcium and addition of calcium in the form of lime or gypsum to clay soil would seem to be beneficial, particularly when growing species from limestone or arid areas. Care must be taken when adding lime since it also affects the pH, making the soil more alkaline.

Magnesium is a constituent of chlorophyll and is thus essential for photosynthesis. It seems to play an important part in the transport of phosphorus in plants and is required for the activation of many enzymes concerned with carbohydrate metabolism and nitrogen metabolism. Magnesium is absorbed in the form of Mg^{2+} ions, is mobile in the plant and is readily translocated from older to younger tissue in the event of a deficiency. In many species the deficiency results in an interveinal chlorosis of the leaves in which only the veins remain green. A magnesium deficiency can be corrected by applying a foliar spray of 1-2% magnesium sulphate (Epsom salts) or by adding dolomite (calcium carbonate-magnesium carbonate) to the soil.

Sulphur is a constituent of protein and is absorbed by plant roots almost exclusively as the sulphate ion (SO_4^{2-}). Sulphur deficiency strongly retards plant growth and is characterised by uniform chlorosis. It is not easily translocated from older to younger plant tissue. As sulphur occurs in fertilisers such as ammonium sulphate, potassium sulphate and superphosphate, and is released by decomposing organic matter, a sulphur deficiency is a rare occurrence.

Micronutrients. Iron, manganese, zinc, copper, boron, chlorine and molybdenum are referred to as micronutrients because plants use them in such small amounts. These elements may limit plant growth either because there are not enough of them in the soil or, as is more often the case, because some condition

The terminal growth point of a calcium deficient (right) and control plant of *Helichrysum bracteatum*. In the deficient plant the expanding leaves display the tip death characteristic of this deficiency.

in the soil, notably pH, reduces their availability. All the micronutrients except molybdenum are more soluble in an acid soil; molybdenum solubility increases with liming. If the soil pH is in the range 5.5-7.0, however, a deficiency in a micronutrient is unlikely to occur.

The micronutrient deficiency most likely to be observed is iron deficiency. While almost all soils contain considerable quantities of iron in the form of iron oxides and iron silicates, other components can interfere with either the ability of plants to absorb enough iron or the use by the plant of iron already in its tissue. Iron deficiency can occur following the addition of excessive amounts of lime to soils or can occur naturally on calcareous soils or soils where there is a layer of limestone close to the surface. It can also be observed when plants native to acid soils are grown close to a house in soil containing waste cement and mortar. This deficiency is referred to as lime-induced chlorosis.

Iron deficiency is most easily corrected by spray or soil application of iron chelates. EDTA-Fe chelate is only effective in acid soils. For alkaline soils the EDDHA-Fe chelate is recommended.

A trace element deficient (right) and control plant of *Helichrysum bracteatum*.

Application of fertiliser

Although most native plant species in their natural state are to be found on low nutrient soils, they will respond, often dramatically, to an increase in soil fertility. This can be achieved by the application of fertilisers. The nutrient application, however, must be balanced. It is not advisable to apply fertilisers containing a predominance of one element in a quick release form unless a deficiency in that element is observed; and then only with extreme care. The use of ammonium sulphate and superphosphate is not recommended. It is much safer to use a complete, preferably slow release, fertiliser. Compost can be employed as such a fertiliser. Blood-and-bone meal can be used as a slow release nitrogen/phosphorus fertiliser. Resin-coated formulations (Osmocote®, Nutricote®) releasing nitrogen, phosphorus and potasium over three–four months, eight–nine months and twelve–fourteen months are available. The 3–4 month formulation is not recommended for Australian native species. Good results can also be obtained using a quicker release NPK fertiliser. Phosphorus, in particular, and possibly potassium, may not need to be applied each year. Nitrogen may be supplied singly in a number of forms including calcium ammonium nitrate, blood meal, ureaformaldehyde and isobutyridene-di-urea (IBDU). The last three release nitrogen slowly.

Fertiliser may be applied at the time of planting. Care must be taken, however, to ensure that fertiliser does not come in direct contact with the roots. Two to three pellets of fertiliser may be placed in the side of the hole or a small amount (50-70 g) of a general fertiliser or blood and bone may be mixed with soil in the bottom of the hole before planting. Both methods give good results.

For established plants fertilisers should be applied before the plant begins vigorous growth. In south-eastern Australia there are two main growth periods—spring and early autumn—and fertiliser can be applied before either or both. All fertilising should be preceded and followed by a good watering.

Dr R. K. Ellyard

Glossary

Abscission—loss of leaves.

Carbohydrates—sugars, starch, cellulose. In plants, cellulose is a principal structural component and starch the principal store food.

Chlorophyll—green pigment found in nearly all algae and higher plants. It is located in the chloroplasts and involved in the trapping of the sun's energy in photosynthesis.

Chlorosis—disease of green plants characterised by a yellow (chlorotic) condition of parts that are normally green, caused by conditions preventing chlorophyll formation.

Enzyme—a protein which is a catalyst (that is, a substance which in minute amounts promotes chemical change without itself being used up in the reaction). There are many kinds, each kind directly promoting only a limited range of chemical reactions.

Ion—electrically charged atom or group of atoms. They may have a positive (cation) or negative (anion) charge.

Meristem—localised region of active cell division in plants from which permanent tissue is derived. The principal meristems occur at the tips of roots and stems.

Necrosis—death of a circumscribed piece of tissue.

Nucleic acid—long chain molecules composed of sugar molecules, phosphoric acid and different nitrogen compounds, universally found in all living things, for example DNA (deoxyribonucleic acid) and RNA (ribonucleic acid).

Nucleoprotein—a large molecule containing a nucleic acid and protein component.

pH—a quantitative expression for acidity or alkalinity of a solution. The scale ranges from 0 to 14, pH 7 being neutral, less than 7 acid and more than 7 alkaline. The scale is logarithmic and a change of one in the pH value represents a ten-fold change in the degree of acidity or alkalinity.

Protein—complex organic molecules composed of numerous amino acids.

Lime-induced chlorosis (iron deficiency) in *Banksia spinulosa* growing near a brick wall in soil containing mortar. Soil pH 7.8.

Lime-induced chlorosis. Plant on the left, grown in soil of pH 8.6, shows the near white new growth observed in severe iron deficiency. The plant on the right was grown in soil of pH 5.8.

ACACIA ADUNCA

Distribution

Acacia adunca: Acacia—may be from the Greek to sharpen, referring to the prickly nature of the first species discovered; another opinion refers to the Egyptian thorn (akakia), a species of *Acacia* which yields gum arabic; *adunca*—from the Latin word, aduncus, meaning hooked or crooked, a reference to the phyllode apex.

This acacia occurs at higher altitudes from southern Queensland to eastern Victoria. These regions have a high rainfall and winter frosts are common.

Acacia adunca can be either a small tree, 6 m high by 3 m across, or a large, spreading shrub, the latter being promoted under cultivation by regular pruning immediately following flowering. This may also serve to lengthen the plant's life span and increase flowering in subsequent years.

The pendulous phyllodes are typically 60-100 mm long and 1.5-3 mm wide with a hooked apex. A protruding marginal gland is usually situated 10-20 mm from the base of the phyllode and a second gland is sometimes present near the middle. The phyllodes are dark green and lustrous and in warm weather may feel oily to touch.

The bright yellow[1] flowers, with numerous stamens in heads, are borne in simple racemes about 30 mm long. They arise from the phyllode axils near and at the ends of branchlets, the aggregate weight of which causes the outer branches to become pendulous during flowering. Flowering is prolonged and prolific, extending from the end of July through August and September to early October, a time of year when colour in the garden is most welcome in Canberra.

An added bonus is the pleasantly sweet fragrance of the flower.

Seed can be harvested during the summer and direct sown in individual containers the following spring. Before sowing, however, boiling water should be poured over the seed and it should be left to soak for several hours. An alternative form of treatment is scarification.

Under cultivation, a position in full sun with ample water and good drainage will suit the plant best. There is an indication in the National Botanic Gardens that, given the plant's native habitat, it will tolerate considerably less water. While the plants are young, however, ample water and applications of nitrogenous-based fertilisers will ensure quicker establishment and maintain vigour.

This acacia appears to be less prone to borer attack and scale insects than other members of the genus. It has strong timber, is not easily damaged in high winds, and is yet another acacia which should be cultivated more widely in Canberra and elsewhere.

R. J. Nipperess

[1] RHS Colour Chart, 1966: flower balls, yellow group 9A.

DENDROBIUM KINGIANUM

Distribution

Dendrobium kingianum occurs naturally in an area along the east coast of Australia between Rockhampton in Queensland and the Hunter River in New South Wales. It grows exclusively on rock faces or among the decaying leaf litter in rock crevices.

A member of the second largest genus of orchids in the world, this Australian representative is well known overseas and has been cultivated for a number of years by many botanic gardens and orchid enthusiasts in Europe and North America.

The nature of this plant lends itself to cultivation. It is a hardy plant often found growing on exposed cliff faces where it is subjected to direct sunlight and extreme heat radiated from the host rock surface. It may also be without water for months at a time. However, the thick canes (pseudobulbs) act as a store and enable the plant to survive these periods of stress.

The spongy roots have adapted well to these conditions. They quickly absorb moisture and nutrients when these are available and as a result small amounts of rainfall and even dew are useful to the plant. During dry periods the roots remain viable and being white in colour reflect some heat. All these adaptive mechanisms enable the plant to survive in a seemingly hostile environment.

There are many colour forms of the flowers of this species. The normal colour is pink, but pure white and almost red forms are not uncommon[1]. The illustration shows two of these forms.

The flowering season is from August to October. Each of the short inflorescences (5–20 cm long) has from one to twelve flowers spaced evenly along it. The inflorescences are terminal to the canes and, in most cases, are held erect. They contrast well with the deep green, leathery foliage.

At the National Botanic Gardens this plant has been grown successfully for years, both out of doors and in glasshouses, although the latter is preferred. Frosts and generally low temperatures during the winter months make outdoor cultivation difficult, though not impossible, in a sheltered but sunny bush-house or fernery. The plants do well in pots 10–15 cm in diameter in a mixture of woodchips and charcoal (not soil). They should be fertilised fortnightly with a liquid organic fertiliser (for example, Nitrosol®) and watered regularly during their growing period, which lasts from August to March.

Aphids and thrip cause the most damage—they attack the flower spikes and are constant pests that need to be watched. Red mites attack the leaves leaving them scarred and brown in colour. These pests are easily eradicated by normal applications of the appropriate pesticide.

Finally, these plants are protected by law and should not be removed from their natural habitat. They are, however, easily obtained from most orchid nurseries.

M. A. Clements

Dendrobium kingianum:
Dendrobium—from the Greek, dendron, meaning a tree, and bios, life; the species are epiphytes; *kingianum*—after P. P. King (1791–1856), a rear admiral in the British Navy and an explorer.

[1]RHS Colour Chart. 1966: flower colour varies from white group 155D, tinged red-purple group 65D and red-purple group 78B.

CALLISTEMON PHOENICEUS

Distribution

There are only two *Callistemon* species included in the spectacular flora of Western Australia—*Callistemon speciosus* and *C. phoeniceus*. The latter is commonly known as scarlet bottlebrush, fiery bottlebrush or lesser bottlebrush.

In Western Australia, *C. phoeniceus* occurs naturally in depressions and along watercourses extending from the Swan River to the Murchison River with its eastern limits in the Norseman area.

In the National Botanic Gardens it forms a large bushy shrub to 3 m high with a spread of about 2 m. The rich scarlet flower brushes[1], 10–15 cm long, are dark tipped and borne terminally on the slender stems. The flowering period is in November and December with a second flowering in late summer if conditions are favourable. This species does not appear to set much seed in Canberra. The narrow leaves, 3–7 cm long, are thick and rigid, tipped with a short spine. Their blue-green colour provides a striking contrast to the brilliant coloration of the flowers.

In cultivation, *C. phoeniceus* is fairly vigorous in its growth habit and will grow in any soil provided ample moisture is available. An open sunny position is preferable and it is tolerant of moist conditions.

The plant benefits from light pruning, particularly in the early stages, and this should consist of general shaping and removal of spent flower heads. An application of a complete fertiliser in early spring will encourage new growth.

Propagation is from seed or tip cuttings using new season's growth.

C. phoeniceus is not affected by frost and no pests have been noted in the Gardens.

This is a very attractive shrub which is hardy and easily grown.

E. Mullins

[1] RHS Colour Chart, 1966: red group 45B.

Callistemon phoeniceus:
Callistemon—from two Greek words meaning beautiful stamens; *phoeniceus,* from the Greek, phoeniceos, meaning purple-red.

EUCALYPTUS RUPICOLA

Distribution

Commonly known as cliff mallee-ash, *Eucalyptus rupicola* is very variable in size in its natural habitat. It may be found on steep slopes or clinging to cliff edges, hence its common name. Reaching 0.5–2 m in height by 1–4 m across, this rare species may be found in small communities in the upper Blue Mountains of NSW.

In cultivation, however, *E. rupicola* rapidly attains a larger stature. At the National Botanic Gardens a newly constructed path runs under a fine specimen, of mallee habit about 3 m high by 5 m spread and about fifteen years old. The foliage is held densely on top of the many stems and the narrow leaves have a dull blue appearance. In autumn, masses of creamy flowers appear among the foliage.

Propagation is by seed sown in spring in a sandy seedling mix. Plants, at present, are not available through normal retail outlets as the plant was only described in 1971. It should be available in specialist native plant nurseries once its value becomes better known.

In the garden situation *E. rupicola* proves a useful and hardy ornamental, growing well in Sydney's sandy soil and coastal conditions and also in Canberra's clay soils. When the new path was being built at the Botanic Gardens, several large stems were removed from the large specimen with no adverse effects. As with all mallees the whole shoot system may be removed to the ground and vigorous growth from the base will result. This type of growth is an adaptation to bushfire conditions in its natural habitat.

E. rupicola will also stand being crowded by other trees, but this treatment is not recommended for best display.

Pests and diseases are limited to some scale insects, leaf-cutting grubs and beetles. Control is dealt with in *Growing Native Plants*, no. 5, p. 112. No evidence of fungal leaf spots or other common *Eucalyptus* diseases have been found.

S. Donaldson

Eucalyptus rupicola: Eucalyptus—a Greek compound from eu, meaning well, and kalyptos, meaning veiled or covered, an allusion to the calyx and/or petals which form a lid over the flower bud; *rupicola*—from the Latin rupis meaning cliff, and cola, dweller, referring to the habitat of the species.

HOMORANTHUS PAPILLATUS

Distribution

Homoranthus papillatus:
Homoranthus—possibly from the Greek homoros meaning neighbouring and anthos, flower; the reason for the name is obscure; *papillatus*—botanical latin, having papillae (superficial protruberances).

In the family Myrtaceae the genera *Homoranthus* and *Darwinia* are closely related. *Homoranthus* includes three or four species and one of them, *H. papillatus*, is found in the Girraween National Park in Queensland, occurring in shallow gritty soils in crevices and flat areas among granite boulders.

Homoranthus papillatus was included with *H. flavescens* until 1981. This latter species occurs on a variety of soils on the western slopes of the Great Dividing Range.

The foliage of *H. papillatus* is unusual and distinctive. Silver to blue-grey leaves are crowded on the upper side of the spreading horizontal branches. Some forms also have an attractive reddish tinge to the foliage. The leaves are three-sided to almost cylindrical, about 10–15 mm long and 1 mm wide.

Branching occurs freely towards the end of the stems. This provides overlapping layers of foliage both at the centre and at the extremities of the plant. The result is a shrub of symmetrical form and a spreading, almost semi-

Homoranthus papillatus

prostrate, habit.

There are some good examples of *H. papillatus* at the National Botanic Gardens where the plants are three or four years old and have reached heights of 40–60 cm and widths of 90–104 cm.

During winter, flower buds develop in the leaf axils near the ends of the branches. Flowering occurs in late spring and summer, usually between November and February. The individual flowers are quite small, but highlight the branches with a touch of yellow[1]. At close proximity the flowers have an unusual scent. Some birds have been observed in search of nectar or fruit.

Propagation has been carried out using new spring or summer wood, since no seed has been found in Canberra. Without a rooting hormone cuttings have taken one or two months to strike.

H. papillatus appears to grow best in situations of diffuse light for the most attractive plants are found in semi-shaded locations. In full sun, despite the presence of a mulch, leaf fall occurs and the plants are sparse and slow growing.

When located in a free-draining situation the plant has also grown reasonably on some heavier imported soils. Given the usual cultural requirements of Australian plants, *H. papillatus* is likely to be a long-lived shrub.

Since most vegetative shoots are located at the ends of branches, the plant is unlikely to respond to severe pruning. Unless dieback occurs, pruning should not be necessary.

This plant is well suited to sheltered shady positions in a rockery or as an undershrub of some taller trees. Interesting effects can be created in group plantings, since the view is equally attractive from the side or above the plant.

Minor damage of flower buds by web-building caterpillars is easily controlled by physical removal.

Grown in a suitable location, *H. papillatus* provides a combination of foliage colour and symmetrical form that is both unusual and strikingly beautiful.

M. S. Lodder

[1] RHS Colour Chart, 1966: yellow-green group 154D.

PULTENAEA VILLOSA

Distribution

Pultenaea villosa: Pultenaea—after Richard Pulteney (1730–1801), an English botanist; *villosa*—from the Latin, villosus, meaning shaggy.

The genus *Pultenaea* is a member of the pea-flower family Fabaceae (or Papilionaceae) and is one of a number of genera more commonly called 'eggs and bacon'. Many members of this family, particularly *Pultenaea* spp. and *Dillwynia* spp., can be a little difficult to establish in a garden situation. *Pultenaea villosa*, however, appears to be an exception to this rule.

P. villosa occurs naturally over a wide area from the south Morton district near Brisbane down the coastal region of New South Wales to Bega on the NSW south coast.

It forms a graceful weeping shrub 2 m high by 3 m across, much branched and spreading. Due to its excellent natural habit the shrub should be allowed to attain its full height and spread to show itself to best advantage. It is thus best grown as a specimen plant. The last 15 cm or so of the branches hang in a weeping manner. The leaves vary in length from 5 mm to 7 mm and are oblong to cuneate in shape. They are covered with dense short hairs giving the whole plant a greyish bloom.

Flowering is from spring to summer and the flowers are bright yellow[1] in colour. Flowering density is high. Fruit is ripe in late summer to early autumn.

In cultivation it seems to appreciate a moist soil with average drainage. The plant performs best in an open position with sun for at least half a day. Those specimens grown in the National Botanic Gardens in heavier shade grow more spindly than those in an open position. Supplementary watering is needed during the warmer summer months.

Although best grown as a specimen plant, the species also makes a good, small, informal hedge and tolerates light pruning very well.

Propagation is carried out by either cuttings or seed and results are reasonably good from both methods. Cuttings should be from newer wood with the soft tips removed. Automatic mist-spray is not desirable during propagation. Before seed is sown it must be treated and chipping, scarifying or hot water treatments are all satisfactory.

Another reason for growing *P. villosa* is the reddish new growth on the branches which looks attractive in late winter and early spring.

P. villosa appears to tolerate moister soils than many other species of pea-flowers and no pests or diseases have been noted. The species is frost hardy.

G. A. Butler

[1] RHS Colour Chart, 1966: yellow-orange group 23A.

ALBIZIA LOPHANTHA

Distribution

Albizia lophantha: *Albizia*—after Filippo del Albizzia, an 18th century Italian naturalist; *lophantha*—from the Greek lophos, crest, and anthos, flower.

Albizia is a genus of 100–150 species belonging to the family Mimosaceae. It consists of trees and shrubs that are mainly tropical and closely allied to the bipinnate (feather-leaved) acacias or wattles; but it does differ in that the stamens are longer and the small petals are united in the lower part.

Albizia lophantha, commonly known as Cape Leeuwin wattle or crested wattle, is one of the few Australian species and the only one occurring in south-west Western Australia; the others are found in tropical Australia.

It is an attractive small tree to about 8 m, very fast growing, especially in coastal areas, with long (up to 20 cm) bipinnate leaves. The greenish yellow flowers[1] appear in early June and flowering continues through the winter months and into September. These are followed by dark seed pods up to 10 cm in length. The tree flowers from an early age and because of its quick growing habit makes good cover for other species.

The trees in the National Botanic Gardens are all young and have yet to reach mature height. In the few years they have been growing, however, one has already reached 2.7 m in height while the others range in height from about 1 to 1.5 m depending on their aspect. The trees are growing in the higher areas of the gardens in rocky Black Mountain loam and are surrounded by *Eucalyptus rossii* and *E. macrorhyncha*, which may reduce the intensity of the frosts during the winter months. Some of the plants have suffered minor frost damage to the new shoots, but the taller trees show no such damage.

The trees have an easterly aspect and receive full sun for most of the day. This seems desirable as there have been a few trees planted in heavy shade and these have not performed nearly so well.

Albizia lophantha occurs naturally in the coastal areas of south-west Western Australia from Fremantle to King Georges Sound. It is used widely as an ornamental plant in coastal districts of South Australia, Victoria, New South Wales and Tasmania and has, in fact, become naturalised in these areas.

Its attractive foliage and habit, plus its long winter flowering period, make it an attractive addition to any garden setting. It appears to be pest free but susceptible to 'windblow'.

N. Fisher

[1] RHS Colour Chart, 1966: yellow-green group 1540.

BORONIA DEANEI

Distribution

Boronia deanei; Boronia—after F. Borone (1769–94), an Italian plant collector; *deanei*—after H. Deane (1874–1924), an English railway engineer and amateur naturalist.

Boronia deanei is now extremely rare in the wild. It is a slightly spreading shrub that occurs naturally in New South Wales in swamps between Clarence and Wolgan in the Blue Mountains and also on the Boyd Plateau.

In the wild, plants are recorded as growing from 75 to 100 cm tall, however, some ten-year-old plants in the National Botanic Gardens are 2 m tall.

With this species, unlike many boronias, drainage seems to be of little importance as plants in both poor and well-drained sites look equally healthy. Moderate shade is tolerated happily but heavy shade causes plants to become sparse and spindly. In Canberra, *B. deanei* shows no sign of frost sensitivity, although a few older leaves do turn yellow and drop off during autumn.

Boronia deanei

Propagation has only been tried by cuttings and good results have been recorded with those taken from October to January.

In Canberra, the pink flowers[1] of *B. deanei* can be seen for about a month beginning in early October. A shrub in full bloom makes a fine display resembling the exotic diosma (*Coleonema pulchrum*) in habit and flower colour. While the flowers are not scented, the small, narrow-linear leaves are pleasantly aromatic and this can be noticed when they are crushed or brushed.

This boronia has also been grown successfully as a potted plant for ten years and with occasional tip pruning, fertilising and adequate water through summer can be maintained as an attractive specimen.

Some sooty mould appears on older plants although this has not been unduly detrimental. No other pests have been noticed.

Although this shrub is not commonly available in nurseries it has proved reliable and adaptable and would be a suitable addition to most gardens.

P. J. Ollerenshaw

[1] RHS Colour Chart, 1966: corolla, red-purple group 73B.

GREVILLEA JOHNSONII

Distribution

Grevillea johnsonii occurs naturally in a restricted area of sandstone hill country north-east of Rylestone in the central tablelands of New South Wales. It grows in sheltered sites in dry sclerophyll forest.

Some confusion has arisen in the past between *G. johnsonii* and the closely related species *G. longistyla*, which occurs in open forest woodland of the Great Dividing Range in central Queensland. Although similar in growth habit, the flower colour of *G. johnsonii* grades from orange to pink while *G. longistyla* grades from orange to red.

Both were considered forms of *G. longistyla* but *G. johnsonii* has now been given specific status.

G. johnsonii is a graceful quick-growing upright shrub with fine, slender, deep green foliage on reddish stems which provide an interesting contrast. This species has performed well at the National Botanic Gardens and exhibits horticultural potential for use in the home garden. It grows to a height of 3–4 m and to a width of 2–3 m.

The waxy flowers with their long, red styles[1] are borne in loose clusters in the upper leaf axils from late winter to early summer. The smooth, long, narrow leaves vary from 15 to 20 cm long and may be entire or deeply divided into three or five segments.

Propagation is from semi-hardwood cuttings taken in October through to March. Seed is slow to germinate and often unreliable. A well-drained, sunny position is preferable with some protection from prevailing winds.

An application of a complete fertiliser in early spring and light pruning after flowering are beneficial.

This species is hardy to frost and no serious pests have been noted at the National Botanic Gardens.

The neat open habit of *G. johnsonii* lends itself to a formal landscape design either as a feature plant or in a group planting. Its attraction to nectar-feeding birds makes it a welcome addition to any garden.

E. Mullins

Grevillea johnsonii: Grevillea—after C. F. Greville (1749–1809), an English patron of botany; *johnsonii*—named in honour of Dr L. A. S. Johnson, Director of the Royal Botanic Gardens, Sydney.

[1] RHS Colour Chart, 1966: perianth, red group 50A grading to yellow group 2D; style, red group 53B; limb, yellow-green group 153A.

MELALEUCA CUTICULARIS

Distribution

Melaleuca cuticularis: Melaleuca—from the Greek, melas, meaning black, and leukos, white. The reason for this name is obscure although it has been suggested that it may be an allusion to the often black trunk and white branches; *cuticularis*—from the Latin adjectival form of cuticula (pertaining to the cuticle), referring to the numerous strips of skin-like bark coming away from the trunk and branches.

Melaleuca cuticularis (syn. *M. abietina*) is a member of the family Myrtaceae and occurs naturally in the Esperance, Albany and Stirling Range districts of Western Australia. It grows naturally on saline soils around estuaries and salt lakes.

It forms a shrub or small tree some 2.5–4 m tall which is fairly dense. The branches of the plant are rigid and tortuous and the leaves linear to oblong up to 1 cm long and dark green in colour. Stems and trunk are clad in a pale papery bark which contrasts well with the foliage. Judicious pruning should be carried out to expose the trunk and lower branches so that this feature can be accentuated. The cream flowers[1], in brushes, are borne terminally on branches and are found from September to November.

In cultivation it seems to be adaptable to a few soil types but mainly prefers slightly heavy, moist soils. It needs protection from wind and seems to prefer full sunlight.

Newly growing tips have been observed to be slightly burnt by frost, but otherwise the species is frost hardy. Specimens in the National Botanic Gardens are sixteen years old.

Fertilising is beneficial and application of calcium ammonium nitrate or a 10:9:8 fertiliser (for example, Multigro®) can be used to advantage. Liquid fertilisers are also useful when the plant is young.

The species is easily propagated by both seed and cuttings. Seeds take seven–fourteen days to germinate under the capillary bed system (see *Growing Native Plants*, no. 2, p. 26) and with cuttings an 80% strike can be expected when they are taken between November and February.

M. cuticularis can be used as a tall, informal hedge or as a specimen plant for damper areas.

Some small attacks by webbing caterpillars have been noted but these are easily controlled by the use of carbaryl spray. Scale has also been seen and can be controlled with Malathion® or Rogor® and white oil.

G. A. Butler

[1] RHS Colour Chart, 1966: white group 155D; anthers, yellow group 3C.

CLEMATIS ARISTATA

Distribution

Clematis, family Ranunculaceae, is a large genus of over 200 species, predominantly climbers and chiefly native to the temperate zones of the northern hemisphere. Six species are endemic to Australia.

Clematis aristata, sometimes called traveller's joy, goatsbeard or old man's beard, is a climber found in the coastal and tableland forests of the eastern States of Australia or on the edges of the eastern rainforests. It has been recorded in Western Australia, but there is doubt about the accuracy of this record.

Flowering in spring, the species is most attractive with its masses of creamy white flowers[1] borne on short branches in the axils of upper leaves. The flowers are 2–3 cm across and consist of four lanceolate petal-like sepals arranged in a star pattern. They enclose numerous silky stamens or slender, plumed styles as the flowers are usually either male or female. The styles on the female flowers persist to form curved feathery appendages on the tightly clustered fruit. In this stage the plant is very decorative and inspires two of the common names—goatsbeard or old man's beard. Leaves are opposite, trifoliate with faintly but irregularly toothed margins. Juvenile foliage is purplish with silver venation.

For best results *C. aristata* should be grown in a position with some overhead shade and in deep cool soil. Liberal mulching with leaf litter would be beneficial. It may be easily trained to cover an artificial support such as a fence, trellis or pergola but naturally enjoys a tree or bush for support.

Germination results are best from fresh seed sown in the summer. The species may also be propagated by striking semi-hardwood cuttings under glass in high humidity.

Pruning is necessary to clear crowded growth to make way for new, more vigorous growth. Pests have not been noticed on this species.

R. T. Jackson

[1] RHS Colour Chart, 1966: white group 155D.

Clematis aristata: *Clematis*—from the Greek name given to *Clematis vitalba*, a plant native to Greece; *aristata*—botanical Latin, bearded, an allusion to the bristle-like appendage of the fruit.

GREVILLEA 'POORINDA ROYAL MANTLE'

Grevillea 'Poorinda Royal Mantle': *Grevillea*—after C. F. Greville (1749–1809), an English patron of botany.

This prostrate cultivar is one of about forty cultivars produced by Mr Leo Hodge, of Victoria. It is said to be a hybrid between *Grevillea laurifolia (Growing Native Plants*, no. 4, pp. 76–7) and *G. willisii*, a recently (1975) described species from Mt Omeo in Victoria.

G. laurifolia is a prostrate or trailing shrub which attains an overall spread of 6 m. Its leaves are entire and between 50 and 130 mm long and about 40 mm wide. The flowers are dense, one-sided and red in colour. It occurs naturally in the higher Blue Mountains of NSW and adjacent valleys.

G. willisii is a large shrub with arching branches of greyish foliage growing to a height of about 2 m with a spread of about 3 m. It has pungent, deeply lobed leaves up to 100 mm long and about 55 mm wide at their broadest point. The flowers are creamy white in one-sided spikes and are borne in spring. This species occurs over a restricted area in eastern and north-eastern Victoria.

G. 'Poorinda Royal Mantle' exhibits the prostrate habit of *G. laurifolia* spreading over 6 m in 2½ years.

The leaves tend to be intermediate between the two parents, showing a range of shapes from entire to irregularly lobed. The entire leaves measure up to 90 mm long by about 20 mm wide while the lobed leaves are about 100 mm long by about 40 mm wide at their widest point.

New growth is densely covered with silky hairs but as the leaves mature the upper surface loses these. The new foliage is coppery red[1] in colour and most attractive.

Dark red, toothbrush flowers are borne terminally on short branchlets and occasionally opposite a leaf on the main stem. The red styles have conspicuous yellow stigmas.

Reports indicate that *G.* 'Poorinda Royal Mantle' is much quicker to establish than its prostrate parent *G. laurifolia*. As a result it is a good plant to choose when a large area is to be treated with a ground cover.

No pests or diseases are known and the plant withstands frost without damage. The cultivar was registered on 28 May 1978.

D. V. Young

[1] RHS Colour Chart, 1966: perinth, greyed-purple group 186A; style, near red group 53D; stigma, yellow-green group 144A.

HYPOCALYMMA CORDIFOLIUM 'GOLDEN VEIL'

Hypocalymma cordifolium 'Golden Veil': *Hypocalymma*—from the Greek, hypo, meaning under, and kalymma, meaning a veil, an allusion to the calyx falling off like a veil or a cape; *cordifolium*—heart-shaped leaves.

There are thirteen species of *Hypocalymma*, all of which occur in the South Western Province of Western Australia. They belong to the family Myrtaceae. One of these species is *Hypocalymma cordifolium (Growing Native Plants*, no. 1, p. 15), a spreading shrub growing to a height of about 1 m with a spread of up to 2 m. It grows well in wet soils but can withstand long dry periods without apparent harm.

The small, heart-shaped leaves are sessile and borne opposite each other on curious minutely winged stems. These stems are bright pink when the new growth is young.

H. cordifolium 'Golden Veil' is a variegated cultivar of this species which resulted from a shoot mutation. It was selected by Mr H. Meyer, of Croydon North, Melbourne, Victoria, in 1968.

The cultivar resembles the normal form of *H. cordifolium* except that it has variegated foliage. The small leaves are irregularly margined with cream[1]. It appears that the variegated form will not reach the same dimensions as the natural form although its compact habit makes it a very attractive specimen for a rockery, garden bed or, if trimmed from an early age, a low neat hedge. The plants in the National Botanic Gardens have not flowered.

The frosty Canberra winters do not cause any serious problems with this plant. Slight tip burn may result after a heavy frost but a quick recovery will be made in spring.

A method of vegetative propagation must be used to maintain the character of this cultivar. The best cuttings are those taken when the growing tips have become half ripe—that is, in about early summer. Success rates should be high as the cuttings strike readily.

There have been no pests or diseases noticed on the plants growing in the Gardens.

The cultivar was registered on 28 May 1978.

[1] RHS Colour Chart, 1966: leaf variegation—leef margin, yellow group 4D; inner portion, near green group 138B.

Hypocalymma cordifolium

D. V. Young

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The Canberra Botanic Gardens was renamed the National Botanic Gardens on 21 December 1978 because the new name was considered more appropriate in view of the national characteristics of the living collection. This is being assembled from field collections undertaken in all parts of Australia, the collected specimens being grown at Canberra and the Gardens' Jervis Bay annexe on the east coast of the continent.

Successive volumes of *Growing Native Plants* will each have a combined index covering all volumes in the series to and including the new issue. The index printed here covers Numbers 1 to 9.

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Back cover: *Hypocalymma cordifolium* 'Golden Veil'

Front cover: *Dendrobium kingianum*

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